What is Claimed:

1.   A masking aperture for an illumination system to provide controlled illumination of a photomask with two dimensional features comprising:

    a translucent substrate;

    a half-tone dithered image on the substrate, said half-tone dithered image comprising an array of pixels for generating a continuous illumination intensity pattern on the photomask with illumination intensity at any location controlled by the half-tone dithered image.

2.   The masking aperture of claim 1 wherein each pixel is a clear or opaque type, said clear and opaque pixels for respectively passing and blocking incident light, wherein the number, size, and type of the pixels are chosen in accordance with:

    (a) the wavelength of light used to illuminate the photomask, and

    (b) the size and shape of the features of the photomask,

3.   The masking aperture of claim 1 wherein the half-tone dithered image comprises an array of diffraction elements and each diffraction element is a dithered image of clear or opaque pixels.

4.   The masking aperture of claim 3 wherein each diffraction element comprises an n x n dithered matrix of pixels, the intensity of each element is defined by the number and type of pixels in its dithered matrix and wherein the pixels in each matrix are dithered to avoid artifacts.

5.   The masking aperture of claim 3 wherein the relative intensity of each element is defined by a recursion relationship where:

$$D^n = \begin{vmatrix} 4D^{n/2} + D_{00}^2 U^{n/2} & 4D^{n/2} + D_{01}^2 U^{n/2} \\ 4D^{n/2} + D_{10}^2 U^{n/2} & 4D^{n/2} + D_{11}^2 U^{n/2} \end{vmatrix}$$

where:

$$U^n = \begin{vmatrix} 1 & 1 & \dots & 1 \\ 1 & & & \\ & \cdot & & \\ & \cdot & & \\ & \cdot & & \\ 1 & & & \end{vmatrix}$$

6. The masking aperture of claim 5 wherein the matrix of pixels of each element comprises an 8 x 8 matrix and the relative intensity, D8, comprises :

$$D^8 = \begin{vmatrix} 0 & 32 & 8 & 40 & 2 & 34 & 10 & 42 \\ 48 & 16 & 56 & 24 & 50 & 18 & 58 & 26 \\ 12 & 44 & 4 & 36 & 14 & 46 & 6 & 38 \\ 60 & 28 & 52 & 20 & 62 & 30 & 54 & 22 \\ 3 & 35 & 11 & 43 & 1 & 33 & 9 & 41 \\ 51 & 19 & 59 & 27 & 49 & 17 & 57 & 25 \\ 15 & 47 & 7 & 39 & 13 & 45 & 5 & 37 \\ 63 & 31 & 55 & 23 & 61 & 29 & 53 & 21 \end{vmatrix}$$

7. The masking aperture of claim 4 wherein the matrix of the diffracting elements is selected from the group consisting of 2 x 2, 4 x 4, 8 x 8, 16 x 16, 32 x 32 and 64 x 65.

8. The masking aperture of claim 1 wherein the elements generate one or more zones of controlled intensity.

9. The masking aperture of claim 8 wherein the zones are symmetrical about the center of the masking aperture.

10. The masking aperture of claim 9 wherein the zones have one shape selected from the group consisting of circles, squares, rectangles, and ellipses, rings, circular rings, square rings, or combinations thereof.

11. The masking aperture of claim 10 wherein the selected shape is a stepped square.

12. The masking aperture of claim 10 wherein the selected shape is an ellipse and the major axis of each ellipse is aligned at a 45-degree angle with respect to the center of the masking aperture.

13.   The masking aperture of claim 1 comprising one or more zones arranged symmetrical about the center of the masking aperture.

5   14.   The masking aperture of claim 1 comprising one or more zones arranged asymmetrical about the center of the masking aperture.

15.   A masking aperture for an illumination system to provide controlled illumination of a photomask with two dimensional features, comprising:

10   a translucent substrate;

an array of diffraction elements on the substrate and each diffraction element comprising a half-tone dithered image of clear and opaque pixels;

each half-tone image comprising an array of pixels, each pixel of a clear or opaque type for respectively passing or blocking incident light, wherein the number,

15   size, and type of the pixels are chosen in accordance with:

(a) the wavelength of light used to illuminate the photomask, and

(b) the size and shape of the features of the photomask, for generating a continuous illumination intensity pattern on the photomask with illumination intensity at any location controlled by the half-tone dithered image.

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16.   The masking aperture of claim 8 comprising a zone with a square ring.

17.   The masking aperture of claim 16 wherein the zone comprises four translucent slots.

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18.   The masking aperture of claim 16 wherein the intensity in the square ring varies from 0 % to 100 %.

19.   The masking aperture of claim 16 wherein the intensity outside the square ring

30   varies from 0% to 99%.

20.   The masking aperture of claim 16 wherein the square ring is combined with one or more zones having a shape selected from the group consisting of square, elliptical, ring, square ring, circular ring, or combinations thereof.

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21.   The masking aperture of claim 8 wherein the zones comprise an annular ring and one or more zones with shapes selected from the group of shapes consisting of square, elliptical, ring, square ring, circular ring and combinations thereof.